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The attached documents are exact copies of the European patent application described on the following page, as originally filed.

Les documents fixés à cette attestation sont conformes à la version initialement déposée de la demande de brevet européen spécifiée à la page suivante.

Patentanmeldung Nr.	Patent application No.	Demande de brevet n°
	99202056.0	

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Blatt 2 der Bescheinigung
Sheet 2 of the certificate
Page 2 de l'attestation

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Order of Titles.

FIELD OF THE INVENTION

The invention relates to a disc like record carrier, such as an optically readable disc, for recording encoded information signals as recited in the preamble of claim 1. The
5   invention relates further to method for recording encoded information signals, an arrangement for performing the method and an arrangement for reproducing data recorded on such a disc like record carrier.

BACKGROUND OF THE INVENTION
10

The DVD-Video format for optically readable discs is defined in the DVD Specifications for Read-Only Disc, part 3: Video Specifications (version 1.0, August 1996). Relevant parts therefrom are being disclosed in for instance European Patent Application EP 724 264 and US Patent 5 784 528, respectively document D1 and D2 in the list of referred
15   documents that can be found at the end of this description. Both documents are incorporated by reference herein.

The DVD-Video format as defined in the above mentioned Specifiations for READ-Only Disc and disclosed in D1 and D2 was created for storing movies and other video content on read-only DVD media. Some of the features of the DVD-Video format make it less
20   suitable for real-time recording applications.

However, it is desirable to create and record video streams and associated data structures on rewritable media in real time which are should preferably be almost identical to the structures defined in the DVD-Video format. Such rewritable discs should be play back
25   compatible with the majority of the installed base of consumer DVD-Video players. The method according to the invention describes a novel and inventive format for DVD-Video compatible real-time recording of video streams, referred to hereinafter to as Real Time DVD Video Recording or shortly DVD-Video Recording. The format defined is intended for home video recording on an optical medium which is playback compatible with DVD-Video players.

The above-mentioned DVD-Video format demands that data for a VTS be allocated contiguously. This gives all kinds of problems when part of the data is overwritten with new recordings:

Seamless playback of non-contiguously allocated data streams is not possible in
5   DVD-Video, except when the data follows a special interleaving structure. Therefore for DVD-Video Recording a seamless Title is always contiguously allocated. This has the disadvantage that the user model of the recording medium becomes very complicated, especial when partial overwrite is one of the features.

10   OBJECT AND SUMMARY OF THE INVENTION

In consequence, amongst other things, it is an object of the invention to obviate above-mentioned disadvantages. According to one of its aspects a disc like record carrier according to the invention is characterized as recited in the characterizing part of claim 1.

This allows a playback device to employ a simple user model in case of real
15   time DVD video recordings. A title menu, used by a player for display and selection, can simply be read from the management area. There is no need to read the information in the video storage area itself and consequently calculating a title menu. This means that a player adapted for playback of pre-recorded DVD Read-Only discs, does not require modification in order to display a proper title menu.
20

Further advantageous aspects of the invention are recited in other, dependent claims.

BRIEF DESCRIPTION OF THE DRAWINGS
25   These and further aspects and advantages of the invention will be apparent from and elucidated in more detail hereinafter with reference to the disclosure of preferred embodiments, in particular with reference to the appended figures in which,

Fig. 1 illustrates the logical data structure of a DVD disc corresponding to an embodiment for DVD Video Recording according to the invention;
30   Fig. 2 illustrates more in detail the structure of the Video Manager area (VMG) of Fig. 1;

Fig. 3 illustrates more in detail the structure of the Video Title Set Information area (VTSI) of Fig. 1;

Fig. 4 illustrates the structure of the Video Manager Information Management Table (VTSI_MAT) of Fig. 2;

Fig. 5 illustrates the structure of the Program Chain Information area (PGCI);

Fig. 6 shows an example of finding a Titles Program Chain Information

5   (PGCI);

DESCRIPTION OF THE EMBODIMENTS

10   The data structure to be disclosed hereafter explains the DVD-Video compatibility behind the Real-Time Video Recording Format and specifies how it should be used by recorders to create DVD-Video playback compatible discs.

To overcome limitations for real-time recording of the DVD-Video format for read-only discs, a number of changes have been made to the data organization and the use of

15   some of the recording parameters in the real-time data stream.

The use of Titles and Menus is restricted to improve exchangeability of rewritable discs between recorders. In addition to this, strict rules are defined for Play Lists, which can be created by the user to define playback sequences of pieces from the recorded Titles.

20   First a list of definitions is given.

Access unit

Coded representation of a presentation unit. See ISO/IEC 13818-1 related to MPEG-2 systems, document D3 in the list of referred documents that can be found at the end

25   of this description, for a more detailed definition of MPEG audio and video access units.

Buffer Cell

Last Cell of a Video Object (VOB) containing just one Video Object Unit (VOBU). The Buffer Cell is not used by any Program Chain (PCGC). The Cell ID of a Buffer

30   Cell is equal to 255.

Cell

Sequence of one or more Video Object Units (VOBU). The first VOBU of a Cell shall contain video data. Cells are the basic presentation units for the Program Chains (PGC)

5

Chapter

Subdivision of a Title. Other word for Part_of_Title (PTT).

DVD-VR Format

10   Short for Video Format Specifications for Real-Time DVD-Video Recording.

DVD-Video format for read-only discs

Format as specified in the DVD specifications for Read-Only Disc- Part 3: Video Specifications (version 1.0, August 1996), elements of which are being disclosed in D1

15   and D2.

DVD-Video format for rewritable discs

Format of DVD-Video related structures with the modifications specified in this disclosure.

20

Elementary stream

An elementary stream is a generic term for a sequence of coded video, coded audio, coded graphics or other access units that can be correctly decoded by a hypothetical decoder operating without special control from an external controller.

25

Free Space

Recording which is represented by a Free Space Title in the Title Search Pointer Table. If the last Recording is free space, it is not represented in this table.

30   **Free Space Title**

Full Title or Play List Title which cannot be played back as the related Program Chain Information contains a pre-command to prevent this. Time_Play(), Time_Search(), PTT_Play() and PTT_Search() for a Free Space Title are blocked. The Cell information in the Program Chain of a Free Space Title may not be reliable.

Full Title

> Title representing one Recording.

> When a Full Title is played, all complete Cells (except the Buffer Cells)
5   contained in the Recording are played in the order of data allocation in the VTS Title VOBS.
Full Titles may be accessible via the Title Menu.

Group of Pictures (GOP)

> Series of coded pictures starting with a GOP-header followed by an intra coded
10   picture. The GOP represents up to 36 display fields at a rate of 59.94 Hz, or 30 fields at a rate
of 50 Hz.

MPEG-2 Program Stream (MPEG-2 PS)

> Program Stream as defined in ISO/IEC 13818-1 related to MPEG-2 systems,
15   document D3 in the list of referred documents that can be found at the end of this description.

Multiplexed stream

> A multiplexed stream is a single bit-stream, combining one or several
elementary streams that can be played in synchronism.

20

Play List (or Play List Title)

> Title representing a play back sequence of Cells from one Recording. Play Lists
are accessible via the Title Menu.

25   **Program Chain (PGC)**

> Playback sequence of Cells for the presentation of a Menu or a Title.

Real Title

> Full Title or Play List Title which is not a Free Space Title.

30

Recording

> Contiguous piece of the VTS Title VOBS, enclosing an integer number of
MPEG-2 PS packs.

The VTS Title VOBS is partitioned into adjacent Recordings which do not necessarily coincide with the VOBs in the VOBS.

Title

5   User accessible unit listed in the Title Search Pointer Table.

Title Menu

This is a menu that gives the user access to Play Lists and optionally to Full Titles.

10

Title Search Pointer Table

Table in the Video Manager listing all available Play Lists and Full Titles on the disc. It is a starting point for finding the data that is relevant for playing back a Title.

15   ### Video Manager (VMG)

DVD-Video data structures containing information about the recorded video data and the Title Menu. The Title Search Pointer Table is one of the elements of the Video Manager.

20   ### Video Object (VOB)

A Video Object is (a part of) a sequence of contiguously recorded Cells, together constituting (a part of) an MPEG-2 Program Stream.

An integer number of MPEG-2 Program Stream packs may be missing from the
25   beginning of the first Cell of the VOB, if this Cell is not used by any Title. The last Cell of a VOB is a Buffer Cell.

A VOB shall contain one video elementary stream. Gaps in the video stream are allowed under conditions specified by the DVD-Video specifications.
30

According to the DVD-Video specifications a VOB may also contain up to eight Audio streams (in elementary audio streams and/or in private streams) and up to 32 Sub-picture streams. The DVD-VR format only allows one Audio stream and one Sub-picture stream within the same VOB.

Video Object Unit (VOBU)

Integer number of MPEG-2 Program Stream packs representing a presentation period between 0.4 and 1.0 seconds.

5   The last VOBU of a Cell has a maximum presentation period of 1.2 seconds. When the VOBU contains Video, the video data consists of an integer number of GOPs and starts with a sequence header, a GOP header and an intra coded picture.

A Sub-picture Unit is optional in a VOBU and cannot cross VOBU boundaries.
10   The SPU's associated validity period ends at or before the end presentation time of the VOBU.

Video Object Set (VOBS)

This is a collection of contiguously recorded VOBs.

15   VOBs which are used for the menus are stored in the Video Manager VOBS (VMGM_VOBS). VOBs which are used for the Titles are stored in the VTS Title VOBS (VTSTT_VOBS).

Fig.1 shows the general data structure in accordance with the Real-Time Video
20   Recording format. The data structure comprises a Lead-In area (LI), a Volume (VOL) and File System area (FS), a Video Manager area (VMG), one Video Title Set (VTS), an area reserved for other structures (OTHER) and a Lead-Out area (LO) as known from the DVD-ROM data structure. Not specifically shown in Fig. 1 is Presentation Control Information (PCI) and Data Search Information (DSI) within the Video Object Set for VTS Titles
25   (VTSTT_VOBS), both dispersed in the Navigation Packs (NV_PCK) of each Video Object Unit (VOBU).

The data organization according to the Real-Time Video Recording format will first be discussed in general.

With respect to the Video Manager (VMG) the following is remarked.The
30   Video Manager (VMG) shall contain a Title Menu. Consequently a Video Object Set for Video Manager Menu (VMGM_VOBS) is mandatory.

With respect to the Video Title Sets (VTS) the following is remarked.The data structure on a disc contains only one Video Title Set (VTS). The Root Menu shall contain a dummy Program Chain (PGC) with a pre-command calling the Title Menu. No other Video

Title Set (VTS) menus shall be present on the disc. Consequently the Video Title Set (VTS) does not contain a Video Object Set for a Video Title Set Menu (VTSM_VOBS). The Video Object Set for Video Title Set Titles (VTSTT_VOBS) of the Video Title Set (VTS) contains the recorded video content.

5   With respect to the Video Object Set (VOBS), the Video Objects (VOBs) and Cells, the following is remarked. A Video Object (VOB) is (a part of) a sequence of contiguously recorded Cells, together constituting (a part of) an MPEG-2 Program Stream as defined in D4. An integer number of MPEG-2 Program Stream packs may be missing from the beginning of the first Cell of the Video Object (VOB), if this Cell is not used by any Title.

10   The last Cell of a Video Object (VOB) is a Buffer Cell, which is not used by any Title.. A Video Object Set (VOBS) is a collection of contiguously recorded Video Objects (VOBs). Video Objects (VOBs) and Cells on a rewritable disc are not fully compliant with the Video Specifications for the DVD Read-Only Disc as disclosed in D2 and D4. The following exceptions are allowed or required:

15   1) The DVD-Video specification demands that a Video Object (VOB) starts with an System Clock Reference (SCR) equal to zero. This is not required for DVD-VR discs.

   2) The Display of the video stream from one Video Object (VOB) does not have to start with a top field nor have to end with a bottom field.

   3) The DVD-Video specification prescribes incremental numbering of Video Objects (VOBs)
20   and Cells. When recording the disc for the first time that requirement can generally be met. However, when old recordings are (partly) overwritten, or when the user does editing, it may not be possible to maintain the incremental numbering. To overcome this problem, DVD-VR format requires that the Video Object Identification number (VOB ID) of all Video Object (VOBs) is equal to '1'. In addition to this, Cell ID numbers (except number
25   255) remain unique but they are allowed to be non sequential.

   4) Video Objects (VOBs) and Cells contain Navigation packs (NV_PCK) with forward references to facilitate forward search. Some of these forward references cannot be known at recording time and therefore must be encoded with values that make legacy playback devices behave in an acceptable way.

30   5) The Navigation packs (NV_PCK) also contain a parameter specifying the presentation termination time of the last video frame of the Video Object (VOB). This parameter cannot be made correct in real time in all cases. To solve this problem a high number will be recorded for this parameter. A Buffer Cell at the end of a Video Object (VOB) guarantees that the end of a Video Object (VOB) is never reached during play back.

With respect to recordings, the following is remarked:

The Video Object Set for Titles in a Video Title Set (VTSTT_VOBS) can be partitioned into a collection of adjacent pieces, called Recordings, which do not necessarilly coincide with the Video Objects (VOBs). Recordings enclose an integer number of MPEG-2 PS packs.

Recordings relate to the partitioning of the content as it is presented to the user. With respect to Full Titles, Play Lists and Free Space, the following is remarked:

For each Recording two One_Sequential_PGC_Titles are created: one Full Title and one Play List. The Full Title defines play back of all complete Cells (except Buffer Cells) of a Recording in the order of allocation in the Video Object Set (VOBS). The Play List may be different from the Full Title. If so it defines play back of a subset of the Cells which are played by the Full Title.

Full Titles and Play Lists are each represented as a Title in the Title Search Pointer Table in VMGI (TT_SRPT) and as a Title Unit (TTU) in the Part_of_Title Search Pointer Table in the VTSI (VTS_PTT_SRPT). A Play List points to the same Program Chain (PGC) as the corresponding Full Title, unless a different Program Chain (PGC)is recorded for the Play List.

Full Titles and Play List Titles are Real Titles, unless they are tagged as Free Space. When a Full Title is deleted by the user, both the Full Title and the Play List in theTitle Search Pointer Table (TT_SRPT) are tagged as Free Space by setting a unique Playback Type value (TT_PB_TY). If two consecutive Full Titles are deleted, the entries in the Title Search Pointer Table (TT_SRPT) shall be combined into one new Title. Also the related Play Lists are combined and tagged as Free Space. Free space that is available on the disc at the end of the VTS Title VOBS or beyond the boundaries of the VTS, is not reflected in the TT_SRPT. Fig. 5 illustrates an example of finding a Title's PGCI.

Within Fig. 5 the following data structures are given: Title Play Back Type (TT_PB-TY), Number of Part_of_Title (PTT_Ns), VTS Title Number (VTS_TTN), PGC_Number (PGCN), Program Number (PGN), VTS Title Number (VTS_TTN), Start Address of VTS Program Chain Information Table (VTS_PGCI-SA), Program Chain Information Table (PGCIT), Number of Angles (AGL-Ns), Parent_ID_field for Title (TT_PTL_ID-FLD), VTS Number (VTSN) and Parent ID-field (PTL_ID_FLD).

Each Title (except for the last Play List Title and the last Full Title) is linked to the next Title by a LinkPGCN instruction in the associated Program Chain Information (PGCI). The Program Chain Information (PGCI) of the last Play List and the last Full Title contains a CallSS to the Title Menu. If the Title is tagged as Free Space, this instruction is

5   stored as a pre-command in the Program Chain Information (PGCI). Otherwise the instruction is stored as a post-command.

The number of Full Titles on a DVD-VR disc is equal to the number of Play Lists with a maximum of 49. Titles can be sub-divided into a maximum of 99 Chapters (Part_of_Titles). The maximum number of Chapters for all Full Titles on one disc is 254.

10   In the following the restrictions and modifications compared to the read-only format will be given.

As already disclosed with reference to Fig. 1, exactly one Video Title Set is recorded on disc. Fig. 2 illustrates the data structure of Video Manager General Information (VMGI) within the Video Manager (VMG) area as shown in Fig. 1. As in Fig. 1, the

15   Presentation Control Information (PCI) and Data Search Information (DSI) are not shown in Fig2, although this information is dispersed in corresponding Navigation Packs (NV_PCK) in each Video Object Unit (VOBU) of the Video Object Set for the Video Manager Menu (VMGM_VOBS).

With respect to the Video Manager Information Management Table

20   (VMGI_MAT), the first 8 bytes of the Provider Unique ID (PVR_ID) contains the string 'DVD-VR01'. The First Play Program Chain (FP_PGC) contains just a JumpSS to the Title Menu as a pre-command.

The Title Search Pointer Table (TT_SRPT) consists of two sections of equal length. The first half contains pointers for N Play Lists and the second half contains pointers to

25   N Full Titles. Play Lists as well as Full Titles are sorted in the order of incrementing start addresses of the first used Cell in the Video Object Set (VOBS). All Titles are One_Sequential_PGC_Titles for which Time_Play() and Time_Search() are blocked. Part_of_Title_Play() and Part_of_Title_Search() shall be blocked for Titles which are associated with Free Space and shall not be blocked for other Titles. Table 1 lists allowed

30   Playback Types as indicated by the Title_Playback_Type (TT_PB_TY) field.

Table 1 Allowed values of TT_PB_TY

Value of TT_PB_TY	Type of Title
0000 0101b	Real Title which is not the last Play List or not the last Full Title
0001 0101b	Real Title which is the last Play List or the last Full Title
0000 0111b	Free Space Title

The Video Manager Menu Program Chain Information Unit Table (VMGM_PGCI_UT) is just linked to the Title Menu. There shall be only one Language Unit.

5 The Video Manager Menu exists in this Language Unit.

Following the Video Title Set Attribute Table (VTS_ATRT), the Video Manager Menu Cell Address Table (VMGM_C_ADT) is restricted to a maximum of 170 cells and the Video Manager Menu Video Object Unit Address Map (VMGM_VOBU_ADMAP) to a maximum of 511 VOBUs. The remaining part of the Video Manager area (VMG) is

10 occupied with the Video Manager Menu Video Object Set (VMGM_VOBS) and the back up of the Video Manager Information (VMGI_BUP).

_____

With reference to Fig. 3, the Video Title Set Information (VTSI) will be discussed. As the Root Menu contains just a dummy Program Chain (PGC) and other menus

15 are not allowed, the Video Title Set (VTS) Menus have no associated Video Object (VOB) data. Consequently the Cell Address Table of the Video Title Set Menu (VTSM_C_ADT) and the Address Map of the Video Object Unit of the Video Title Set (VTSM_VOBU_ADMAP) do not exist.

The Management Table of the Video Title Set Information (VTSI_MAT)

20 comprises the following area (not shown in the figure):

- the VTS Video Attributes (VTS_V_ATR) (the video compression mode complies with MPEG-2),

- the number of Audio Streams (VTS_AST_Ns) describing the number of different audio stream attribute sets used in this VTS,

25 - the VTS Audio Stream Attribute Table (VTS_AST_ATRT) listing the different audio stream attribute sets which are defined (and may or may not be used) for this VTS. The PGCI for each Title defines which of the sets is actually used,

- the number of Sub-picture Streams (VTS_SPST_Ns) (set to one in this VTS) and

- the VTS Sub-picture Stream Attribute Table (VTS_SPST_ATRT) (all fields in this table

30 are zero)

The Video Title Set Information (VTSI) further comprises further a Video Title Set Part_of_Title Search Pointer Table (VTS_PTT_SRPT) wherein the Title Units are recorded in the same order as Titles in Title Search Pointer (TT_SRPT).

Next is present a Video Title Set Program Chain Information Table

5   (VTS_PGCIT). The number of Video Title Set Program Chain Information (VTS_PGCI) search pointers is equal to the number of Titles in Title Search Pointer Table (TT_SRPT). The search pointers are recorded in the same order as the Titles. All Program Chains (PGCs) are Entry PGCs with all bits zero for Block mode, Block type and Parental ID Field (PTL_ID_FLD). When a Play List is equal to the associated Full Title, their Start Address of

10   Video Title Set Program Chain Information (VTS_PGCI_SA) values are identical.

With respect to the Video Title Set Menu Program Chain Information Unit Table (VTSM_PGCI_UT) the following is remarked. The number of Video Title Set Menu Language Units as specified in VTSM_PGCI_UTI shall be 1. There is exactly one Video Title Set Menu Language Unit Search Pointer (VTSM_LU_SRP). The Video Title Set Menu

15   Existence field (VTSM_EXST) shall contain the value (1000 0000b) to indicate that just the Root Menu exists. The Video Title Set Menu Language Unit (VTSM_LU) contains just one Program Chain Information Search Pointer (VTSM_PGCI_SRP). The Video Title Set Menu Program Chain Category parameter (VTSM_PGC_CAT) for the Video Title Set Menu Program Chain (VTSM_PGC) contains the value (8300 0000h) indicating that the associated

20   Program Chain (PGC) is the Entry PGC for the Root Menu. There is exactly one Video Title Set Menu Program Chain Information (VTSM_PGCI).

The Video Title Set Time Map Table (VTS_TMAPT) contains Video Title Set Time Maps (VTS_TMAPs) that are present for all Titles on the disc but do not contain any map er tries.

25   With respect the Video Title Set Cell Address Table (VTS_C_ADT), the parameter containg the number of Video Object in the Video Title Set (VTS_VOB_Ns) contair s the contains the value '1'. It is noted that the VTS_VOB_Ns does not reflect the actual number of VOBs in the Video Object Set of a rewritable disc. It is set to 1 as the VOB ID number of all VOBs is set to '1'. All Video Title Set Cell Piece Information (VTS_CPI)

30   have the same value ('1') for the Video Title Set Video Object ID Number (VTS_VOB_IDN). Exactly 254 VTS_CPI blocks are recorded with VTS_C_IDN starting from '1' and incrementing up to and including '254'. The Start Address and End Address of the Video Title Set Cell Piece (VTS_CP_SA and VTS_CP_EA) of Cell Pieces which are not

referenced by any PGC of a Real Title contain the value (0000 0000h). It is noted that Cell

Pieces that are referenced by a PGC of a Free Space Title contain zero start and end addresses.

With respect to The Video Title Set Video Object Unit Address Map

(VTS_VOBU_ADMAP) it is remarked that all Video Object Unit (VOBU) start addresses of

5   the VOBUs which are completely contained in VTSTT_VOBS are listed here in ascending

order. It is noted that VOBU start addresses of VOBUs which are part of Free Space are also

included in the VTS VOBU Address Map.

Next the structure of the Program Chain Information area (PGCI) for Title

Program Chains will be given with reference to Fig. 5. This structure comprises a Program

10   Chain General Information Area (PGC-GI), a Program Chain Command Table (PGC_CMDT),

a Cell Playback Information Table (C_PBIT) and a Cell Position Information Table

(C_POSIT).

With respect to the Program Chain General Information (PGC-GI) it is noted

that exactly one of the Availability flags in the Program Chain Audio Stream Control Table

15   (PGC_AST_CTLT) is set to (1b). When the ith Availability flag is set, the ith Audio stream

parameter set defined for this Video Title Set (VTS) is valid for this Program Chain (PGC).

The Decoding Audio stream number is always '0'.

The availability flag of the first Program Chain Sub-picture Stream Control

(PGC_SPST_CTL) field in the Program Sub-picture Stream Control Table

20   (PGC_SPST_CTLT) is set to (1b). All other bits of the Program Sub-picture Stream Control

Table (PGC_SPST_CTLT) contain the value (0b).

The Program (PG) Playback mode in the Program Chain Navigation Control

(PGC_NV_CTL) is set to sequential playback. The Still time value is set to no Still.

The PGC Command Table (PGC-CMDT) contains exactly three commands.

25   According to this version of the specification only one command is actually used (for Title

linking). the other two commands are NOP commands (0000 0000h). Which command is used

for Title linking is defined in Table 2.

14   25.06.1999

Table 2   Commands in PGCI

PGC associated with ...	contains ...	as a ...
Real Title which is not the last Play List or not the last Full Title in TT_SRPT	LinkPGCN to PGC of next Real Title	post-command
Real Title which is the last Play List or the last Full Title in TT_SRPT	CallSS to Title Menu	post-command
Free Space Title	LinkPGCN to PGC of next Real Title	pre-command

5
With respect to Cell Playback Information Table (C_PBIT): Cells are not part of an Angle Block and do not exist in an Interleaved Block.

With respect to the Cell Position Information Table (C_POSIT): the Identification Numbers of the Video Objects of alll Cells in the PGC contain the value '1'. It is noted that, on DVD-VR discs, all VOBs have the same VOB_IDN.

10
It is allowed that the Cell ID number of a Cell of which the Seamless playback flag set in Cell Playback Information, is not the same as the previous Cell ID number incremented by 1.

With respect to the Presentation Control Information (PCI) it is noted that modifying a Play List may require that a Cell is split into two new Cells. In that case all values of Cell Elapse Time (C_ELTM in PCI_GI) shall be updated in all PCI fields in the second
15
Cell.

Additional data fields with respect to the DVD-Video format for Read-Only discs for carrying real-time stream attributes are given below.

The last reserved 32 bytes of the General Information of Presentation Control Information (PCI_GI) are redefined in this specification as shown in table 3

Table 3 Redefinition of reserved fields at end of PCI_GI

		Contents	Number of bytes
	Reserved	Reserved	16 bytes
(8)	PCI_GI_XI	PCI_GI Extension Information	1 byte
(9)	RT_V_ATR	Video Attributes	1 byte
(10)	RT_AST_ATR	Audio Stream Attributes	1 byte
	Reserved	Reserved	13 bytes
		Total	32 bytes

PCI_GI_XI identifies the application and specifies the length of the extension.

5   If all bits in this byte are zero, also the bytes of PCI_GI following this field are zero:

b7	b6	b5	b4	b3	b2	b1	b0
Application Identifier				Extension Length			

Application Identifier contains the value (0001b) if the stream attributes as defined in VTSI_MAT for this VTS must be overruled by the real-time stream attributes.

10   Otherwise contains the value (0000b). The real-time stream attributes are valid from Start PTM until End PTM of the VOBU in which this field is contained.

Extension Length defines the number of bytes for this extension following this field. It shall contain the value (0010b) if Application Identifier is (0001b). It contains the

15   value (0000b) if Application Identifier is (0000b).

RT_V_ATR describes the real-time Video stream attributes.

b7	b6	b5	b4	b3	b2	b1	b0
Aspect ratio		Reserved		reserved	Source picture letter boxed	reserved	Film camera mode

16   25.06.1999

Aspect ratio, Source picture letterboxed and Film camera mode have meanings as defined in the DVD specifications for the Read_Only Disc.

RS_AST_ATR describes the real-time Audio stream attributes:

b7	b6	b5	b4	b3	b2	b1	b0
reserved				Surround Type		reserved	

5

Surround Type as defined in the DVD Specifications of the Read-Only Disc. With respect to Data Search Information (DSI) it is noted that all VOBs are allocated in Contiguous Blocks and there are no Angles.

With respect to the Data Search Information General Information (DSI_GI) it is
10   remarked that the Video Object ID number (VOB ID) number is always 1. Further there is no requirement that the Cell ID numbers are monotonically increasing from 1 in the Video Object. The following rules shall be applied for Cell ID:
–   Cell ID is identical in all VOBUs belonging to the same Cell
–   Cells which are used by Real Titles are uniquely identified by their Cell ID
15   It is noted that modifying a Play List may require that a Cell is split into two new Cells. In that case all values of Cell Elapse Time (C_ELTM in DSI_GI) shall be updated in all DSI fields in the second Cell.

With respect to Video Object, it is remarked that an integer number of MPEG-2 Program Stream packs may be missing from the beginning of the first Cell of the VOB, if this
20   Cell is not used by any Title. The last Cell of a VOB is a Buffer Cell.

t is noted that seamless connections between VOBs are excluded.

nly one Audio stream is allowed within a VOB. The Audio decoding stream number is '0'.

nly one Sub-picture stream is allowed within a VOB. The Sub-picture decoding
25   stream number is '0'. Data for a Sub-picture Unit (SPU) is fully contained in one VOBU. The SPU validity period shall not start before the Start PTM of the VOBU, nor shall it end later than the End PTM of the VOBU.

The DVD-Video format for rewritable discs is not fully identical to the DVD-Video format for read-only discs. The differences are (1) in the rules for data allocation and
30   (2) in some details of the navigation data in the real-time data streams. The first kind of differences generally has no consequences for DVD-Video players. As a consequence of the second kind of differences in some cases trick mode behavior of DVD-Video playback devices

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with rewritable discs may not be always exactly the same as with prerecorded discs.
Manufacturers can improve compatibility between DVD-Video players and rewritable discs
by following the guidelines given in the next.

5   With respect to VOBS Structures: on rewritable DVD-Video discs some rules
for the Video Object Set data structures are different from the rules for read-only discs. DVD-
Video players will play back rewritable discs well when they are robust against:

- non-sequential numbering of VOBs in the VTSTT_VOBS
- non-sequential numbering of Cells within a VOB
- the existence of remnants of partly overwritten Cells or other unused data in between

10   "active" Cells

- modified rules for forward search pointers as defined next :

DVD-Video recorders are required to at least fill in correct forward pointers FWDI(n)
for $n \leq M$. Forward pointers FWDI(n) with $M < n \leq N$ contain the last correct value. For $n >$
N forward pointers point to the end of the current Cell. The duration of a Cell on a rewritable

15   disc is typically 60 seconds.

This means that for forward search functionality DVD-Video players can still rely on the
FWDI pointers for the lower speeds (2x, 4x, 8x). For higher speeds, the player can still use the
long distance FWDI pointers but in this case they point to the end of the current Cell. If
accurate fast search speeds are desired, the speed can be adjusted by picking up intermediate

20   pictures (e.g. by applying a FWDI(6) pointer) or by adapting the display period of the pictures.

Although the invention has been described with reference to preferred
embodiments thereof, it is to be understood that these are not limitative examples. Thus,
various modifications thereof may become apparent to those skilled in the art, without
departing from the scope of the invention, as defined by the claims. The invention can be

25   implemented by means of both hardware and software, and that several "means" may be
represented by the same item of hardware. Further, the invention lies in each and every novel
feature or combination of features. It is also remarked that the word 'comprising' does not
exclude the presence of other elements or steps than those listed in a claim. Any reference
signs do not limit the scope of the claims.

30

LIST OF REFERRED DOCUMENTS

(D1) European Patent Application EP 724 264
(D2) US Patent 5 784 528

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(D3) ISO/IEC 13818-1 : 1995 Information Technology – Generic Coding of moving pictures
and associated audio information : Part 1 : Systems (MPEG2-systems)

CLAIMS:

1.   A disc like record carrier, such as an optical disc, for storing an encoded bit
stream, said encoded bit stream representing a plurality of video objects comprising a
sequence of cells constituting a part of an MPEG2 Program Stream, said record carrier
comprising

5   a management information storage area for storing information about recorded
video objects and title menus and

          a video object storage area comprising a collection of contiguously recorded
video objects, characterized in that,

          said collection is partitioned into adjacent pieces that do not necessarily
10   coincide with the video objects and represent playable titles and

          said management information area comprises a title table listing titles in an
order that corresponds to the physical allocation of the titles on the record carrier.

2.   A disc like record carrier according to claim 1, wherein said title table and said
15   collection corresponds respectively to the Title Search Point Table (TT_SRPT) in the Video
Manager General Information (VGMI) and the Video Object Set for Video Title Set
(VTS_VOBS) according to the DVD Read-Only Video Specification.

ABSTRACT:

A disc like record carrier for storing an encoded bit stream, said encoded bit stream representing a plurality of video objects comprising a sequence of cells constituting a part of an MPEG2 Program Stream, said record carrier comprising a management information storage area for storing information about recorded video objects and title menus and a video

5   object storage area comprising a collection of contiguously recorded video objects.

Said collection is partitioned into adjacent pieces that do not necessarily coincide with the video objects and represent playable titles while said management information area comprises a title table listing titles in an order that corresponds to the physical allocation of the titles on the record carrier

10   This allows a playback device to employ a simple user model in case of real time DVD video recordings.

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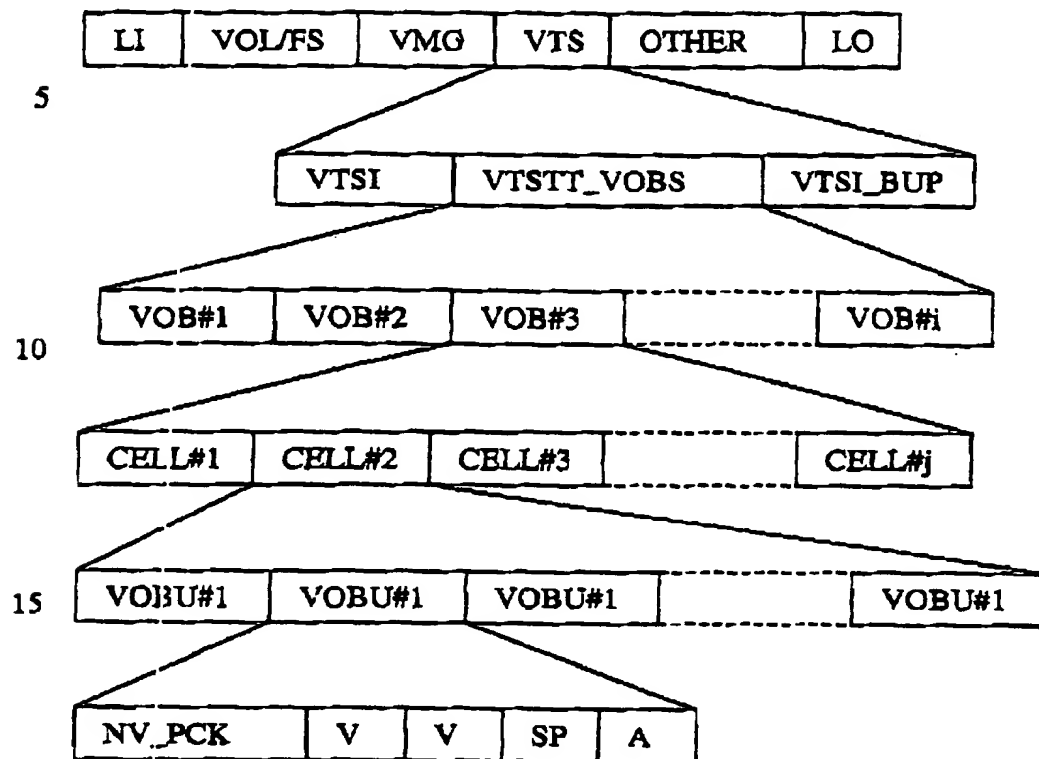
LI	VOL/FS	VMG	VTS	OTHER	LO

5

VTSI	VTSTT_VOBS	VTSI_BUP

VOB#1	VOB#2	VOB#3		VOB#i

10

CELL#1	CELL#2	CELL#3		CELL#j

VOBU#1	VOBU#1	VOBU#1		VOBU#1

15

NV_PCK	V	V	SP	A

20

FIG. 1

5

VMG

VMGI	VMGM_VOBS	VMGI_BUP

VNGM_C_ADT	VMGM_VOBU_ADMAP

VMGI_MAT	TT_SRPT	VMGM_PGCI_UT	VTS_ATRT

10

FIG. 2

FIG. 3

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FIG. 4

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5

| PGCI |

| PGCI_GI | PGC_CMDT | C_PBIT | C_POSIT |

FIG. 5

10

15

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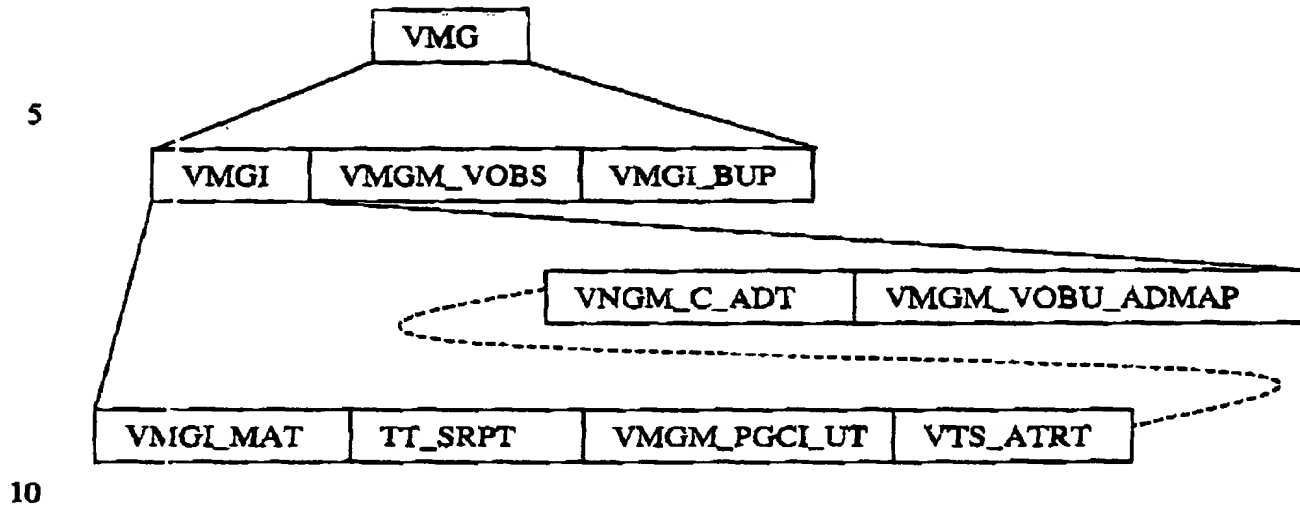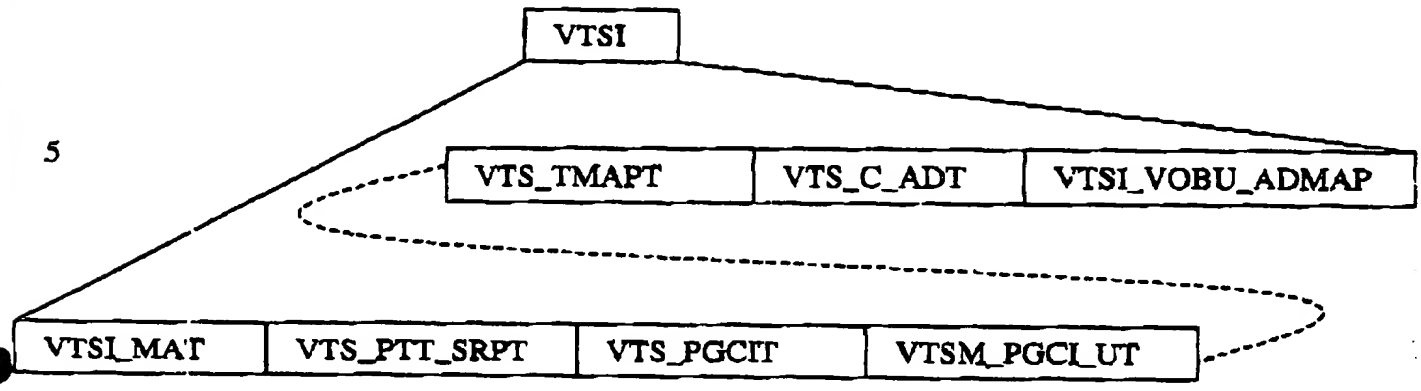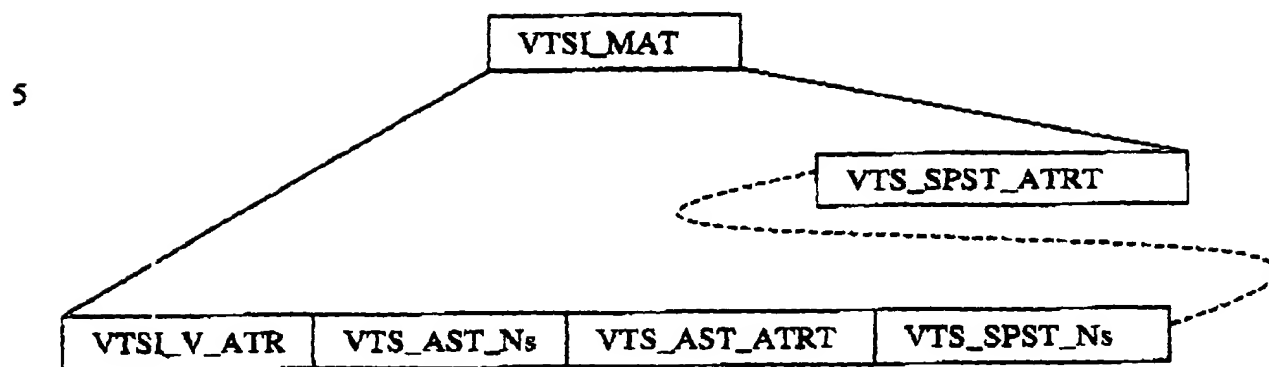
VTSI / VTS_PTT_S

<table>
<tr><th></th><th>EXAMPLE</th><th colspan="3">VMGI / TT_SRPT / TT_SRPs</th></tr>
<tr><th></th><th></th><th>TT_PB_TY</th><th>PTT_Ns</th><th>VTS_TTN</th></tr>
<tr><td rowspan="10">PLAY LISTS</td><td>PLAY LIST 1</td><td>0000 01x1</td><td></td><td>1</td></tr>
<tr><td>PLAY LIST 2</td><td></td><td></td><td>2</td></tr>
<tr><td></td><td></td><td></td><td>..</td></tr>
<tr><td>AS ORIGINAL I</td><td>0000 0101</td><td>4</td><td>I</td></tr>
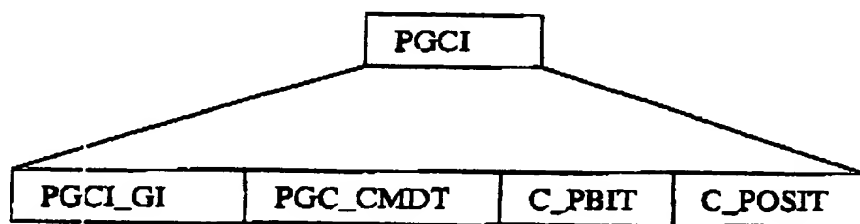<tr><td></td><td></td><td></td><td>..</td></tr>
<tr><td>PLAY LIST K</td><td>0000 0101</td><td>3</td><td>K</td></tr>
<tr><td></td><td></td><td></td><td>..</td></tr>
<tr><td>FREE SPACE</td><td>0000 0111</td><td>1</td><td>M</td></tr>
<tr><td></td><td></td><td></td><td>..</td></tr>
<tr><td>PLAY LIST N</td><td>0001 01x1</td><td></td><td>N (< 50)</td></tr>
<tr><td rowspan="12">ORIGINALS</td><td>ORIGINAL 1</td><td>0000 01x1</td><td></td><td>N+1</td></tr>
<tr><td>ORIGINAL 2</td><td></td><td></td><td>N+2</td></tr>
<tr><td></td><td></td><td></td><td>..</td></tr>
<tr><td>ORIGINAL I</td><td>0000 0101</td><td>4</td><td>N+I</td></tr>
<tr><td></td><td></td><td></td><td>..</td></tr>
<tr><td>ORIGINAL K</td><td>0000 0101</td><td>5</td><td>N+K</td></tr>
<tr><td></td><td></td><td></td><td>..</td></tr>
<tr><td>FREE SPACE</td><td>0000 0111</td><td>1</td><td>N+M</td></tr>
<tr><td></td><td></td><td></td><td>..</td></tr>
<tr><td>ORIGINAL N</td><td>0001 01x1</td><td></td><td>N+N</td></tr>
</table>

AGL_Ns   == '1'
TT_FTL_ID_FLD   == zero
VTSN   == '1'

Bit 1 of TT_PB_TY indicates free space

FIG. 6A

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VTSI / VTS_PTT_SRPT / TTUs	
PGCN	PGN
1	1
	..
2	1
..	..
I	1
	2
	3
	4
K	1
	2
	3
M	1
N	1
N	..
N+1	1
	..
N+2	1
..	..
N+I	1
	2
	3
	4
N+K	1
	2
	3
	4
	5
N+M	1
N+N	1
	..

5

FIG. 6B

ONTV :   EPA/EPO/OEB RIJSWIJK   :25- 6-99 : EP99202056.0   +31 40 743489→P12/ ++31 70 34 SPEC
PHN 17.316 EP-P
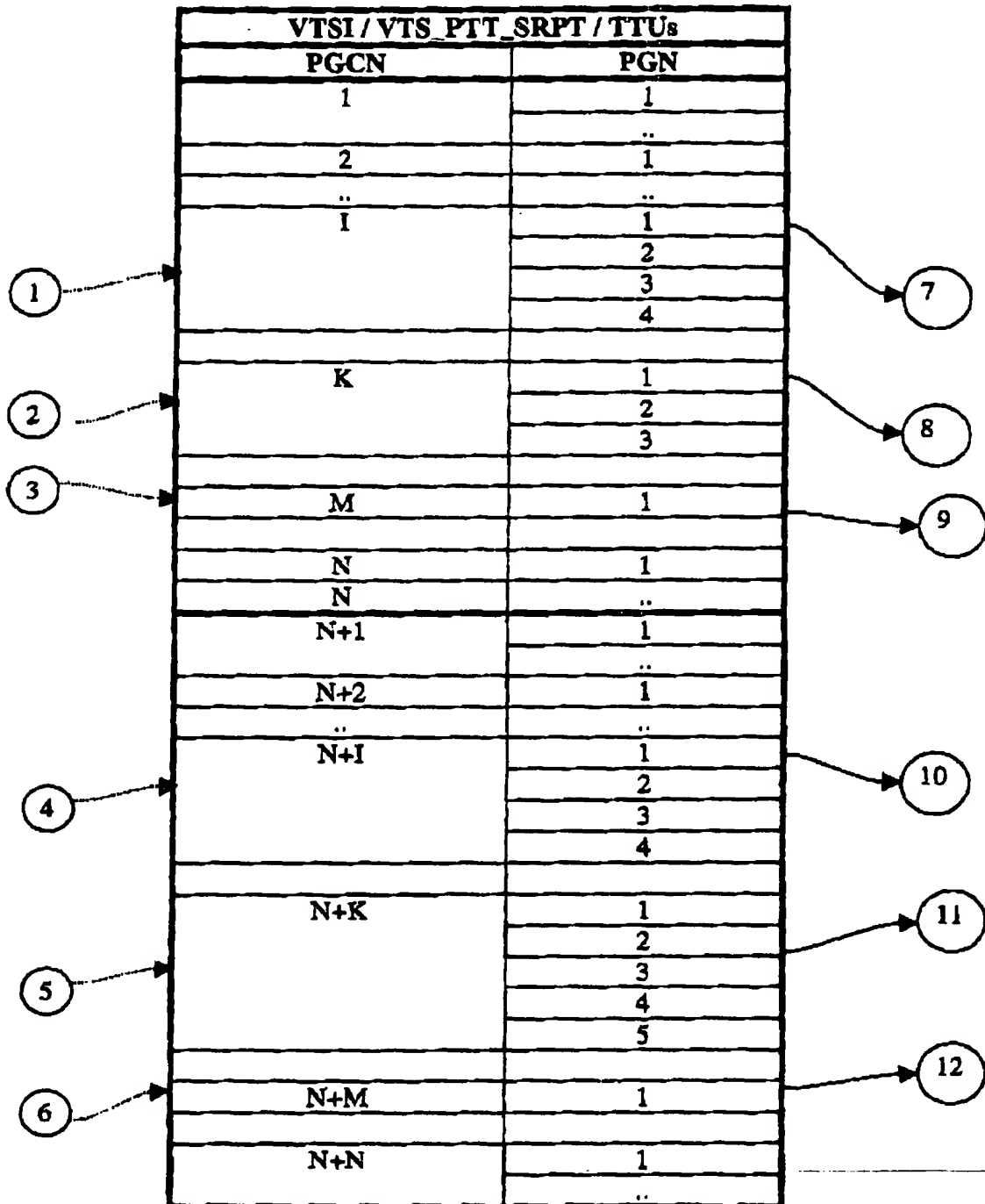
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5

VTSI / VTS_PGCIT / VTS_PGCI_SRPs	
VTS_TTN	VTS_PGCI_SA
1	
2	
..	
I	→ ORIGINAL I PGCI
..	
K	→ PLAY LIST K PGCI
..	
M	→ FREE SPACE M PGCI
..	
N	
N+1	→ ORIGINAL 1 PGCI
N+2	→ ORIGINAL 2 PGCI
..	
N+I	→ ORIGINAL I PGCI
..	
N+K	→ ORIGINAL K PGCI
..	
N+M	→ FREE SPACE M PGCI
..	
N+N	→ ORIGINAL N PGCI

```
       Entry type     == 1
       Block mode     == 00b
10     Block type     == 00b
       PTL_ID_FLD == 0000h

       Equal VTS_PGCI_SA indicate "no THL"
```

15

FIG. 6C

20